

## The Use of Slide Culture to Study Individual Cell Activity

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Typically, students study the growth of unicellular microbes (bacteria, yeast) through examination of changes in the concentration of a population over time. In such studies, cells are inoculated into a growth-supporting broth (e.g. Nutrient Broth), and the culture is evaluated for growth throughout an incubation period by determination of optical density or the number of colony forming units. This approach is useful, but it does not allow for examination of individual organisms within the population. Slide culture is a technique that allows the growth and division of individual cells within a population to be studied. In slide culture, a molten agar-containing culture medium is layered with a pipet onto a microscope slide and allowed to solidify. A small volume of a microbial culture is dropped onto the center of the culture medium, the liquid is allowed to absorb into the agar, and a coverslip is gently applied. The slide is incubated and the growth and division of individual cells is monitored by microscopy at a magnification of 1000x or below. Depending on the experimental question and the incubation time, the slide culture can be incubated directly on the stage of a microscope so that the same cells can be observed over time. (If the microbe is an obligate aerobe or will be affected by limited oxygen supply, it may be necessary to apply the coverslip after incubation, just before microscopic examination.) Slide culture can be modified by students so they can ask a variety of experimental questions. For example, they can examine the effect of changes in the growth medium as well as changes in the incubation conditions. They can evaluate the response of the microbes by determination of lag time (the amount of time it takes for an individual cell to divide for the first time) and the percentage of cells within the population that are capable of division and microcolony formation. Any unusual growth patterns exhibited by the microbes can also be observed.

Slide culture can also be used to examine the growth of mixed microbial populations. These can be precise mixes of known organisms or mixed populations from natural settings (e.g. aquatic environments). It can be used to study specific microbial processes, such as the formation and germination of bacterial endospores. Slide culture can be adapted to study organisms other than bacteria and yeast. For example, classic experiments that study chemotaxis of the slime mold *Physarum polycephalum* can be adapted to a slide culture system by placing the slime mold at one end of a microscope slide that has been layered with non-nutrient agar and a food source (e.g. oat) at the opposite end. Directional movement of the slime mold can be observed by the naked eye, but slide culture allows for more detailed study of associated cellular processes, such as cytoplasmic streaming.